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A HALF-CENTURY OF ACHIEVEMENT BY THE ILLINOIS AGRICULTURAL EXPERIMENT STATION[1]

By the late Dr. H. W. MUMFORD

DEAN OF THE COLLEGE OF AGRICULTURE AND DIRECTOR OF THE AGRICULTURAL EXPERIMENT STATION

THE responsibility for evaluating the work of the Illinois Agricultural Experiment Station for the period of half a century is a task from which any thoughtful person might well shrink, not because it is an unpleasant duty, but because adequate treatment of the subject is obviously impossible. The findings of the station over this period have been reported in painstaking detail in some thousands of printed pages. The human record is found in changed practices on the farms of the state and in a higher level of living than would otherwise have been possible. All I can do is to choose examples that will illustrate something of the underlying objectives and policies of the station and that will be suggestive of the scope and significance of its work.

Starting with the establishment of the Morrow plots in 1876 and the initiation of the Soil Survey in 1902, the station, through an unbroken program of research, has accumulated a wealth of knowledge concerning the soils of Illinois, on the basis of which land-use programs can be intelligently planned and the land resources conserved as a continuing source of wealth.

The oldest experimental plots of their kind in the United States, the Morrow plots have stood as incontrovertible evidence of the tragedy of faulty soil management and the promise that is held out to the future in intelligent soil management. From 44 bushels of corn an acre in the early years of these plots, good methods of soil management have advanced yields to 66 bushels. On adjacent land, depleted by continuous cropping to corn year after year, the yields are now only 24 bushels, and they are still declining.

But after all the Morrow plots cover less than an

[1] Abstract of address at the fiftieth anniversary of the Illinois Agricultural Experiment Station, March 25, 1938. Dr. Mumford died on May 14.

acre on the campus of this university, while the farm lands of the state total some 35 million acres. What do we know about them? To this question our Soil Survey started thirty-six years ago and our system of outlying soil experiment fields provide the answer. Of fifty-odd fields established from time to time since 1896, approximately half are now in operation. The long records from these fields furnish detailed guides to long-time profitable methods of cropping and soil management.

One of the earliest and most far-reaching moves toward a permanent soil fertility was the launching, about 1905, of the sweet-clover program—the growing of sweet clover to be plowed under as a green-manure crop. Almost no one, at the time this program was undertaken, recognized sweet clover as a useful crop for soil building, for feed, or for anything else. On many of the soils of the state sweet clover would not grow at first, and its usefulness seemed limited—until the cause was discovered in the acidity of the soil, a condition remedied by the simple method of applying ground limestone. So well have Illinois farmers learned this lesson that they now apply to their soils more than a million tons of limestone a year—one sixth of all the agricultural limestone used in the United States.

It is obvious from what I have just said that one of the great objectives[2] of this station is the conservation of the land resources of the state. This is basic. What may be said to be the other major objectives? As I view them there are five others:

1. *To reduce production and marketing costs* through the development of better grains, fruits, vegetables, dairy products and live stock, through more efficient methods of production and marketing, and through more effective methods of disease and insect control.

2. *To improve the quality of farm products,* thus benefiting the public and under normal economic conditions making better profits possible for the farmer.

3. *To help farmers adjust their production to demand* through better balanced production and orderly marketing.

4. *To broaden the market out... for farm products,* which is done not only by finding new crops with new uses, and new uses for old crops, but is done also by following two of the objectives just mentioned—lowering costs and improving quality, thus enabling farmers to get their products on the market at prices and in forms that will stimulate broader consumption.

5. *To discover facts that will enable homemakers* to know better how to feed their families; that will enable farm families to know better how to utilize home-grown foods and, through a study of living expenditures, to know better how to use their incomes.

And through all these ways, and other ways, to contribute to a more satisfying country life—a desirable thing in itself and a stabilizing influence in public welfare.

Second only in importance to conserving land resources as a continuing source of wealth to the state is the first objective just listed:

Reducing the Costs of Production and Marketing

I believe it is true in farming, as Dr. Moulton, of the Brookings Institution, has pointed out that it is in industry, that "only by everlastingly improving technical processes and lowering the cost of production can we obtain higher standards of living. To try to accomplish this result in any other way simply means tugging in vain at our collective bootstraps."

The Illinois Station is pursuing investigations that should contribute to a better understanding of price shifts and changes and how to cope with them, but its major contribution has been—and I believe logically so—on the side of cost reduction, which benefits both farmers and consumers. Practices that assure good crop yields per unit of land, the intelligent selection and feeding of live stock, the selection of the right crop rotations, the control of destructive plant and animal diseases and insect pests, the economical use of machinery and men, soil-improvement practices—all are pointed toward keeping costs down.

Farm management studies have shown the sources of the leaks in the farm business, where the weak spots in the organization of a farm may be, and how to correct them. Fundamental studies in animal nutrition have shown how feeding standards can be altered so as to increase their effectiveness and reduce their cost.

Improving the Quality of Farm Products

To realize the progress that has been made in this field, we have only to remember the way in which the fluid milk supply and the great volume of milk products have been improved in quality and in safety in recent years, and of the increased availability of graded fruits, vegetables, meat and eggs. Notable among the investigations at this station that have contributed to the improvement of dairy products has been the work establishing the effectiveness of the pasteurizing process as a means of protecting consumers against undulant fever, diarrhea, bovine and avian tuberculosis, and other diseases that may be carried in milk and milk products.

More sanitary methods of feeding dairy cattle, the control of herd diseases, the proper cleansing of dairy utensils, and improved marketing methods have been

[2] This statement of objectives was first used in an exhibit of the Station's work prepared for the biennial visit of the Illinois General Assembly in May, 1933.

reflected in the vastly improved quality of the 5 million pounds of butter sold annually from Illinois farms and the 67 million pounds of creamery products.

The quality of Illinois' leading fruit crop—peaches—the value of which in some years reaches more than two million dollars, would be greatly improved, experiments show, by thinning the fruit later in the season than has been popularly supposed. An improved spray program for the control of codling moth, developed by the station in cooperation with the National History Survey, has not only greatly reduced the losses from this pest, estimated at a million dollars a year, but has greatly improved the quality of the crop marketed. Furthermore, these investigations are leading to the working out of an insecticide that will not leave an undesirable spray residue on the fruit, as may happen when arsenate of lead is used.

Swine-type studies extending over several years indicated the medium type of hog as most desirable. With Illinois farmers marketing more than fifty million dollars' worth of hogs annually, the significance of this information may be realized.

But what will it avail us to reduce costs and improve quality if the public does not want or can not buy our products? We come then to the problem of—

Adjusting Production to Demand

Some eleven years ago, in talking before a Farm and Home Week audience, I pointed to the urgent need to find some way of adjusting productive efficiency to the changing demand for agricultural products. In the face of dwindling demand for some of our major Midwest crops, we had increased the possibilities of production by developing new varieties, improving grains and live stock, finding better cultural methods, and learning better how to control diseases and insects. Surpluses were threatened which would depress prices to such an extent that production would no longer be profitable.

In order to work out ways and means of meeting this problem, a series of "agricultural adjustment conferences," one in each farming-type area of the state, was begun in October, 1928, by the College of Agriculture, through its Station and Extension Service, in cooperation with the farmers themselves. These conferences were continued annually until the inauguration of the federal adjustment program in 1933.

The Illinois plan was essentially a plan of education. It was clear, however, that education alone, and in a single state, would not then, nor will it now, solve the problem of adjusting agricultural production to demand. But the agitation of the question did more perhaps than anything else to impress upon farmers, and the general public as well, that some of the problems in agriculture could not be solved by individual farmers or even by individual states—adjustments on national and regional scales were obviously necessary.

So the station has been cooperating with the federal government and with neighboring states in efforts to determine desirable regional adjustments in agricultural production. Here in our own state we are fortunate in being able to draw upon the findings of the Soil Survey, on long-time farm-accounting studies, and on numerous other phases of our station work in bringing pertinent facts to bear on these adjustment problems. For agricultural adjustment is infinitely more than production control, which some have assumed it to be.

Although this station has always considered it one of its functions to explore the desirability of introducing new crops into our agricultural scheme to take the place of old-established crops for which demand has declined, the problem of finding and making such introductions was not brought into prominence until new conditions and new developments forced it into a major position. One result in Illinois has been a spectacular expansion of the soybean acreage and the development of the soybean industry.

Detailed cost account studies begun in 1912 and farm financial records and enterprise cost records started soon thereafter have furnished a wealth of data making possible a more intelligent analysis of the farm business from the standpoint both of the individual farm and the status of agriculture as a whole. Illinois is perhaps the only state that has carried on detailed cost records continuously for a quarter of a century.

Another significant step toward helping farmers put production on a better business basis was taken in 1925, with the inauguration of the Farm Bureau Farm Management Service. By 1930 approximately 800 farmers were enrolled in this service, all paying fees that largely financed the work. The accounts kept by these farmers, besides being of direct and immediate value to those enrolled, have furnished the basis for one of the best types of farm-management investigations yet undertaken.

To the extent that agricultural research agencies make significant contributions in the field of agricultural adjustment will they establish themselves more firmly in the confidence of farmers and the general public.

Broadening Market Outlets

Discovering new uses for established crops or developing new crops with new uses is obviously a way to broaden market outlets for farm products, but outlets can also be broadened by lowering prices to consumers and processors and other users through the lowering of costs of production and by improving the quality of farm products and the way in which they are

marketed. The station must continue to devote its efforts to all these methods. The increasing of export trade and the buying power of the public at large are of course vital factors in this problem, but they must be dealt with by other agencies.

Enlarged research directed toward discovering new uses for farm products and by-products is the purpose for which the liberally financed regional laboratories provided for in the Agricultural Adjustment Act of 1938 will be established. The Federal Soybean Laboratory already located at this station is equipped to make notable contributions in this field, as will other laboratories in other fields and in other locations. The public must be patient, however, for the results of such research are slow in materializing, and it may be years before these efforts will result in substantial outlets for our major agricultural commodities. It is unfortunate perhaps that this is not the kind of quick-acting farm relief that stimulates public enthusiasm and sustained support.

Discovering Facts of Value to Homemakers

Research in the Department of Home Economics at Illinois was started early in its history. Expansion was made possible in 1925 with the passage of the Purnell Act. Recent investigations have been concerned with the vitamin value of certain foods, and with nutritional problems resulting from a lack of certain of these elements. The combined extension-station project for the development of home accounting and the determining of the levels of living enjoyed by farm families has attracted wide attention. A study just completed has resulted in the identification of 17 varieties of soybeans having superior qualities for table use.

Studies in rural architecture, in the electrification of the farm home, and in home equipment have not only stimulated the interest of farm people in the possibilities of adding attractiveness and convenience to their farm homes, but also have demonstrated with what economy this can be done.

Conclusion

In this brief sketch I have had to omit mention of lines of work and accomplishments just as comprehensive, just as significant, just as well done as those that I have cited for illustrative purposes. When I remind you that the last annual report of the station carried results from some 300 organized projects, you can see why only a bare outline can be given at a time like this.

I have not mentioned the names of my colleagues who have helped guide this work nor of the men and women who have produced these results. I can only say that the opportunity accorded me to help mold the situations in which members of this great research staff could do their work has been an honor and a privilege. Through the years, the staff has increased in experience and in academic maturity. There has developed a closer integration of departments and divisions for concerted attack on different phases of complicated problems. In late years a whole new group of workers has been organized into what is now known as the Department of Agricultural Economics.

I have said nothing of the excellent working relations established between farm people and the Experiment Station through the Extension Service, which is organized to carry the results of the station's research directly to rural people. I have said nothing of the vision of the state and national legislative bodies that have provided the funds making the work of this station possible.

I have refrained from anticipating the future of this organization. I have done this because I am confident that what the future is to be may safely be left to those whose responsibility it will be to guide its destinies. But of one thing we may be sure—with the growing complexities of agriculture the need for research will increase rather than diminish in the years ahead.

EARLY DAYS OF THE ILLINOIS AGRICULTURAL EXPERIMENT STATION[1]

By Dr. EUGENE DAVENPORT

DEAN EMERITUS OF THE COLLEGE OF AGRICULTURE

It is my privilege to speak of the early days of the Illinois Agricultural Experiment Station; others will speak of its achievements.

When I first knew the station it had been in existence but seven years and was operating on a budget of $15,000, all federal money. It had bought out the College of Agriculture; that is to say, all the agricultural equipment of the university belonged to the station, instruction had been abandoned except for a "winter school," and the main farm was rented. Last year's budget for research in agriculture amounted to something over a half million dollars alongside a third

[1] Abstract of an address by Dr. Eugene Davenport, dean emeritus, College of Agriculture, University of Illinois, at the fiftieth anniversary of the Illinois Agricultural Experiment Station, March 25, 1938.

of a million for instruction, not to mention the extension service.

How did this feeble thing attain such vast proportions in half a century? Not so long indeed for, to be exact, it is not quite thirty-seven years since the State of Illinois determined to enlarge its facilities for research into the sciences that underlie a successful agriculture.

In a marked degree the station drew upon two sources of great strength. The first was the spirit of research that characterized the personnel of the young and struggling state university. The second was the confidence of farmers and of the legislature, yes, of governors, in what science could do for farming and for a state like Illinois through the development of its agriculture.

Both of these sources of strength will bear a word of detail. First of all was that "grand old man" of blessed memory, Dr. T. J. Burrill. Prophet-like, he could vision a new earth through science put to work. I can see him yet at our first meeting forty-three years ago. There he stood in the fields speaking of some things that might be done for agriculture and of what the doing of them might mean to the state. As his eye swept the horizon, his arm extended as beckoning a coming day. Almost reverently he exclaimed, "And this is Illinois."

A scientist by instinct and habit of thought, Dr. Burrill followed almost unblazed trails in the field of bacteriology. He began the study of fruit diseases and leaf blight in 1871, and in 1876 reported bacterial invasion as the cause of pear blight. In 1880 he reported his success in producing this disease artificially by inoculation. This was two years before Koch isolated the tubercle bacillus. He was truly a pioneer in pioneer times.

Then there was Professor Morrow, who, for many years, campaigned the state for a better agriculture. Horrified by the current assertion that the soils of Illinois were "so rich they would never wear out," he started on the Rothamsted plan what Dr. Hopkins so fittingly named "The Morrow Plots," whereby in time the land itself could be depended upon to refute the fallacy. This was two years before the passage of the Hatch Act; yet here was the true spirit of research, an appeal to facts rather than resort to argument.

The spirit of Burrill and Morrow was at work in the other colleges. There was Forbes, the entomologist, not only a source of strength in the early days of the station but a power in the state in attracting attention to the growing menace of insect ravages and the value of birds in their amelioration. Across the campus were Ricker and Talbot developing manual training into engineering. In chemistry were McMurtrie and Scovell and later Palmer and Parr, not to mention many others who saw in the Experiment Station the first opportunity for organized service in science.

Illinois did not, like some neighboring commonwealths, establish a state experiment station in advance of the Hatch Act. It was, nevertheless, sensitive to the spirit of research; and in this connection we must not forget that here was the first invasion of the prairie by the restless white man, bent on what he called "improvement."

So it was that as early as November, 1868, a committee of the trustees reported in favor of extensive plantings of forest trees for the production of material "at home" for "railroad ties, culverts, cars, roadways, buildings, fencing, vineyard stakes, hop poles, stanchions for coal banks, soft wood for berry boxes, crates and staves, hoop poles, carriage and wagon materials, agricultural implements and the multiform wants of the age." They certainly had a comprehensive view of the situation.

They also had in mind the planting of "wind belts" as a protection from the northern blasts, and at the March meeting following this report the board appropriated out of its slender funds the sum of $1,000 for "seeds and trees" in order to learn the species best suited to prairie conditions.

But we must not judge these early efforts by modern standards. Science was then still in its swaddling clothes. At that time the chemist was doing business with only a few more than half a hundred elements, all "absolutely indivisible," and I knew one teacher who still clung to the four old fundamentals: earth, air, fire and water. Nobody yet had even surmised the solution of the so-called "nitrogen mystery" and the tubercles on the roots of clover were considered a disease by the best botanists. The work of Mendel, the Austrian monk, was unknown in college circles. Galton was a name not yet heard, and Weismannism was twenty years in the future.

Yet Dr. Burrill was hard at work in bacteriology ten years before the tubercle bacillus had been isolated. In December, 1893, he published a report on orange rust of raspberries and blackberries, with an appendix entitled, "A New Factor in Economic Agriculture." In this appendix he comments on the most important single discovery in all the field of agriculture; namely, the solution of the so-called and long-discussed "nitrogen mystery." And he raises the question whether these nitrogen-gathering bacteria might be so modified as to live on the roots of the grass family. He conducted some preliminary experiments in that direction with slight suggestions of success in the case of corn but entirely negative as to oats.

These altogether inadequate allusions to the early experimental work of the university show how intensely alive to the problems of the farm as well as to the

new phases of science were these pioneers in agricultural research; and they make clear how necessary were additional funds if the possibilities that lay ahead were ever to be adequately realized.

ENTER THE FARMERS

At this point the farmers of the state undertook the task of providing additional funds. They were already perfectly organized for the purpose and withal somewhat experienced in the art and procedure of agricultural legislation, having previously secured the passage of two bills, one providing $150,000 for an agricultural building, the other increasing the funds of the college fourfold. To determine the character and scope of the new building a joint committee of farmers and trustees had paid a visit to the agricultural colleges of Wisconsin, Michigan, Canada, New York and Ohio, after which they filed a unanimous recommendation that the largest possible building be erected within the limits of the appropriation. By the time the building was done, the registration in agriculture had increased from six to eighty-seven, and at the dedication of the structure in 1901 it numbered 150. The farmer's efforts were being justified. With this experience behind it, the committee was in position to serve as a powerful ally of the station when it took up the cause before the legislature of 1901. This it did through the famous "Bill 315," known everywhere by its house number.

The bill was drawn in seven sections, one for each agricultural interest at that time represented by a definite organization. Section one made it the duty of the college to "maintain typical specimens representing the various market classes and the several pure breeds of livestock and to give instruction in stock judging and the most advanced and approved methods of livestock husbandry." It also made it the duty of the Experiment Station to "conduct feeding experiments intended to determine the most successful combination of stock foods . . . and to investigate livestock conditions both at home and abroad so far as they affect livestock values. . . ."

Section two provided for experiments on the production of corn; section three, for the study of the chemical and physical characters of the various soil types of the state. Section four related to orchard management, section five to the production of "wholesome milk," and through section six it was proposed to learn whether Illinois should undertake the production of sugar beets. (The last-mentioned matter was settled the first year and in the negative.)

The work under each section was to be carried on "along lines to be agreed upon by the Director of the Experiment Station and a committee of five" to be appointed by the association corresponding to the interest covered by the section. Section seven provided that these committees should serve without compensation except for actual traveling expenses. As the bill was drawn in its entirety by a committee of the associations represented, it was clear that public welfare, not individual profit, was the impelling motive.

The bill totaled $54,000 annually. Over a hundred thousand dollars for agricultural research in a single biennium! So far as I am aware, no such proposition had ever been presented to a state legislature. It must have looked to many like a leap in the dark. The only argument was the ability that science had shown in settling some of the problems that were plaguing the farmers and the certainty that if only one could be disposed of in the biennium it would more than repay the cost of the whole attempt.

No trickery was ever resorted to. The whole matter was put on the basis of public welfare and the ability of the university to conduct a kind of experiment that the farmer could not conduct for himself. The farmers did not hesitate to remind the legislators that they were paying their full share of the taxes. In the words of L. H. Kerrick, who had been in former legislatures: "We do not come asking favors. All we ask is your permission to put our hands into our pockets and take out some of our money with which to develop our business." And he did not hesitate to point out further that in a very large sense agriculture is a matter of intense public concern.

To everybody's credit it should be said that the farmers' bill never got in the way of the university interests. Besides, as legislators came to realize the power of science to solve the problems of agriculture, it was but a step to the realization that funds devoted to education and research in any line of public interest are an investment rather than an expenditure, contributing not only to the welfare of individuals but to the development of the state as well. Indeed, it is not too much to say that the larger view of the function of the university is in no small measure due to the labors of these farsighted farmers of the early days.

And now a word must be said for the governors of the time who, without exception, lent their sympathy and support to this new and strange sort of legislation. But this does not mean that these bills were "hammered through" by the executive's dictum. Quite the contrary, for in Illinois administration is administration and legislation is legislation—a fortunate distinction this for education as well as for good government, especially in these days of magnifying the executive.

ACADEMIC FREEDOM

Illinois has been so free from outside interference that she can hardly realize all that "academic freedom" means. She is one of fewer than a half dozen states in which the trustees are elected by the people, rather than appointed by the governor either with or without legislative approval.

"How can the best board be secured?" is a question often asked. But the "best board" is not the primary issue, which is the *source of authority*. When the board is elected by the people, its mandate is as direct and independent within the field of education as is that of the governor or the legislature in that of government. And that is right, for education is an extra-governmental enterprise.

When the board is appointed by the governor, that officer is, on the face of things, as much responsible for the proper operation of a university as for that of an asylum or a penitentiary. And he not seldom acts upon the theory that such operation is an executive matter rather than legislative. In one notable case the governor discharged four boards and appointed new ones, resulting in the peremptory discharge of four faculties and the appointment of a new personnel, all of which did not enhance the reputation of the state in academic circles.

Many institutions are the victims of "efficiency experts" who regard everything as "business" and would have "a business man" for university president. In these states everything is secondary to the machinery of government. In several states a finance board, of which the governor is chairman, can withhold any part or all of an appropriation after it has been made by the legislature. In some states the state purchasing agent is often the cause of delay and waste of funds because of his unfamiliarity with the great range of university needs.

All of which leads me to believe, after correspondence with our kind of institution in every state of the Union, that there are many facts and situations that have not yet entered into the calculations of the expert organizer; and that the best way to have a great institution of higher education and research is for the citizens to support it liberally, then let it grow naturally in ways that will meet the needs of the times and the locality.

SCIENTIFIC EVENTS

MEDICAL RESEARCH IN CANADA

A SURVEY of existing facilities for medical research in Canada is to be made under the auspices of the Associate Committee on Medical Research established in March last by the National Research Council, according to an announcement made at the close of the organization meeting of the committee held recently in Ottawa. Sir Frederick Banting, chairman of the committee, will personally conduct the survey, visiting each of the principal centers to learn at first hand of the work that is in progress. An assistant secretary is to be appointed to aid Sir Frederick in the conduct of the survey and to carry on the routine work of the committee.

Discussions on a number of proposed activities of the committee took place, but it was the consensus of opinion that beyond the consideration of matters of general policy it would not be possible to shape a definite program until the results of the survey were made available for study. Stress was laid on the advantages to be gained by the further coordination of work that is being carried on in the principal centers of medical research in Canada. It was felt that much of the benefit to be gained through the newly established committee would be in the stimulus it could give and the assistance it could render to existing institutions for medical research.

Proposals were put forward that the committee should plan to provide for scholarships in medical research and also to grant financial assistance for the conduct of research in universities and hospitals on approved projects. It was agreed, however, that owing to the limited funds available to the committee at the present time no action should be taken immediately on these matters.

In view of recent press statements suggesting that the Associate Committee on Medical Research would set up at this meeting a national scientific committee to investigate purported cancer cures throughout Canada this subject was raised for consideration. After the subject had been discussed at some length the committee agreed that the investigation of reputed cancer cures was not a matter on which the committee could take any action at the present time.

Those present at the meeting were: *Chairman,* Sir Frederick Banting, University of Toronto; *ex-officio members*—Major-General A. G. L. McNaughton, president, National Research Council, Ottawa; Dr. R. E. Wodehouse, deputy minister, Department of Pensions and National Health, Ottawa; Dr. T. H. Leggett, president, Canadian Medical Association, Ottawa; Dr. George S. Young, president, Royal College of Physicians and Surgeons of Canada, Toronto; Members—Dr. G. H. Ettinger, department of physiology and embryology, Faculty of Medicine, Queen's University, Kingston, Ont.; Dr. A. Grant Fleming, dean of the

Faculty of Medicine and professor of public health, McGill University; Dr. J. E. Gendreau, director, Radium Institute, University of Montreal; Dr. Duncan Graham, head of the department of medicine, Banting Institute, University of Toronto; Professor V. E. Henderson, secretary-treasurer of the Banting Research Foundation, Toronto; Dr. Donald Mainland, professor of anatomy, Dalhousie University, Halifax, N. S.; Dr. C. L. Pierre Masson, professor of pathological anatomy, University of Montreal; Dr. J. C. Paterson, director of the pathological department, Civic Hospital, Ottawa; Dr. W. G. Penfield, professor of neurology and neuro surgery, McGill University; Dr. P. H. T. Thorlakson, assistant professor of surgery, Faculty of Medicine, University of Manitoba.

REPORT OF THE NEW YORK COMMITTEE FOR THE STUDY OF HOSPITAL INTERNSHIPS AND RESIDENCE

AT a recent meeting of the Greater New York Hospital Association, the forthcoming report of a three-year survey of internships and residencies in the hospitals of New York City was discussed by Dr. F. L. Babbott, chairman of the New York Committee for the Study of Hospital Internships and Residencies, and by Dr. J. A. Curran, executive secretary. The New York Committee was sponsored by the five medical colleges of New York City and the New York Academy of Medicine. In its work, the committee has had the cooperation of ninety-seven voluntary and municipal hospitals in the municipal area. The study has been financed through grants made by the Commonwealth Fund, and the report will be published by the fund.

Dr. Curran pointed out that New York City occupies a leading position in the country in the education of doctors. At the time of the survey, 103 medical colleges in all parts of the United States, in Canada and in several foreign countries furnished over 2,000 graduates for advanced training in the internships, residencies and other house-staff services in the 182 hospitals of all types in New York City. Seventy-seven of these hospitals have been approved by the American Medical Association and were offering house-staff training to 1,968 individuals.

The report stresses the length and the arduous nature of the modern medical course. In New York City, besides the usual four years in medical college, at least two additional years of internship are considered necessary before a doctor may safely assume independent responsibility for the care of the sick.

The close association between medical colleges and hospitals was shown by the fact that 1,353 out of the 1,968 house-staff members were in hospitals having some degree of medical college affiliation. Hospitals were divided into three groups—"teaching," "affiliated" and "non-teaching"—according to the degree of their participation in the undergraduate programs of the several medical colleges in the city. Over ninety-five per cent. of the internships in the so-called non-teaching hospitals were rotating (attempting to cover all services in the hospital), while most of the straight internships (on one service only) and mixed internships (on two or three services only) were provided by the teaching and affiliated hospitals. It is, therefore, important to consider the educational standing of the complete rotating internship.

The committee attempted to evaluate each step of the medical-educational process. A comparison of the preparation of the graduates of American and foreign medical schools showed in most instances the superior quality of the education received in the American institutions, as applied to intern requirements in this country. The survey demonstrated the need for better organized education of the interns, for in approximately half of the hospitals systematic introduction to their duties and continued instruction and supervision could be much better organized.

In addition to the internships, it was shown that there were 577 residencies and fellowships in 53 of the 77 hospitals of the city approved by the American Medical Association. Through these opportunities, interns have obtained advanced training in special fields. In the majority of instances, it was concluded that the residencies have greatly enhanced the quality of care given the patients and have been of valuable assistance in the teaching of students and interns.

The committee has undertaken a program of annual revisitation of hospitals cooperating in plans for improved house-staff education. Material gathered is said to have been invaluable in the guidance of undergraduates seeking internship placement. These revisits have revealed increasing interest in better education of the interns, and in better provision for their housing, recreation and health care. A serious obstacle has been insufficient funds for these needs.

THE ONE HUNDRED AND FIFTIETH ANNIVERSARY CELEBRATION OF THE LINNEAN SOCIETY

THE one hundred and fiftieth anniversary celebration of the Linnean Society of London was opened on May 25 in the rooms of the Royal Institution, when the Linnean Medal was presented to Sir D'Arcy Wentworth Thompson, and the president, John Ramsbottom, keeper of botany in the British Museum (Natural History), delivered his presidential address.

According to an account of the meeting given in the London *Times*, among those present were many foreign

members and delegates from institutions and societies in Sweden, France, Belgium, Denmark, Holland, Germany, the United States, Portugal, India and other countries. Congratulatory addresses were received from learned societies both abroad and at home, and there were expeditions to places of scientific interest. On the evening of May 26 a dinner was held at the Rembrandt Hotel, and on the following evening the president held a reception in the society's rooms in Burlington House.

In presenting the Linnean Medal to Sir D'Arcy Wentworth Thompson, the president said:

> The Linnean Society, while maintaining the traditions associated with the great Swedish naturalist whose name it bore, had always welcomed to its fellowship the disciples of new schools. It seemed to the council especially fitting that at this one hundred and fiftieth anniversary meeting the highest honor in its gift should be conferred on a naturalist who, more than any other of our time, had shown himself to be at home in both the old and the new learning. Their founders, Sir James Smith and Bishop Goodenough, would have approved the ripe scholarship of Sir D'Arcy Thompson's "Glossary of Greek Birds" and of his translation of Aristotle's "Historia Animalium," which were in the eighteenth-century tradition no less distinctly than his "Growth and Form," already a classic on the shelves of the younger biologists, was in that of the twentieth.

Sir D'Arcy Thompson expressed his thanks.

The title of the presidential address of Mr. Ramsbottom was "Linneaus and the Species Concept." A symposium on "The Concept of Species from the Time of Linneaus to the Present Day" was held on May 25, which was taken part in by Sir Edward Poulton, Professor E. W. MacBride, emeritus professor of zoology of the Imperial College of Science, South Kensington, Professor O. Winge, of Copenhagen, and Dr. Karl Jordan, of the Tring Museum. A second symposium entitled "Geographical Isolation as a Factor in Species Formation" was held on May 27. The speakers included: Dr. Julian Huxley, secretary of the Zoological Society of London; Professor P. A. Buxton, of the London School of Hygiene and Tropical Medicine; Dr. E. Fischer-Piette, of the Muséum National d'Histoire Naturelle, Paris; Professor B. Rensch, of Münster, and Professor Karl Skottsberg, of Göteborg.

At a formal meeting of fellows, John Ramsbottom was reelected *president;* I. Henry Burkill and M. A. C. Hinton, *secretaries,* and Francis Druce, *treasurer.*

THE OTTAWA MEETING

JUNE 27 TO JULY 2

THE preliminary announcement of the Ottawa meeting of the American Association for the Advancement of Science was published in the May 20 issue of SCIENCE. Although the prospects for a fine meeting were promising in May, they are now materially better. As the programs of the sections and of the affiliated societies have taken final form they have aroused continually increasing interest and enthusiasm.

All the sections of the association, except that on mathematics, will present programs at Ottawa. Since the subsection on pharmacy will have independent sessions for presenting papers in its field, there will be fifteen sectional meetings. In addition, eighteen affiliated societies will meet in Ottawa. Perhaps the best measure of the magnitude of the meeting is the number of scientific sessions, of which eighty-one are scheduled and before which several hundred papers will be presented. These sessions are exclusive of numerous field trips and excursions, which on the whole are as truly contributary to science as are formal presentations of the results of investigations. The dinners and luncheons serve an equally useful purpose.

In the preliminary announcement emphasis was placed on the symposia, of which fourteen are scheduled. A number of the symposia, but not all of them, are sponsored jointly by two or more sections or societies. For example, the Section on Medical Sciences and the Section on Chemistry hold a joint symposium on "Medical Biochemistry." An illustration of a joint symposium exclusively by affiliated societies is that of the American Phytopathological Society and the American Society of Plant Physiologists on "Microelements and Deficiency Diseases." An example of a symposium presented under the joint auspices of a section and affiliated societies is that on "The Genetics of Pathogenic Organisms," which is participated in by the Section on Medical Sciences, the Genetics Society of America, the Phytopathological Society and veterinary and bacteriological groups.

All the symposia to be presented at Ottawa are listed in the preliminary announcement except that on "Atmospheric Ozone," which has been organized by Dr. Brian O'Brien, of the Section on Astronomy. Other speakers in this symposium, which will be held on Thursday morning, June 30, are Dr. B. Haurwitz, Dr. E. H. Gowan and Dr. Chaim Pekeris.

In addition to the fourteen symposia, a number of sections and societies will hold joint scientific sessions, as well as joint luncheons and dinners. There are fourteen such joint scientific sessions, including a few somewhat formal ones that are classed as symposia. As has often been pointed out, in these integrations of different fields the association is making one of its greatest contributions to science.

The distribution of formal sessions for the presentation of scientific papers is as follows: Monday, June 27, 14 sessions; Tuesday, 24 sessions; Wednesday, 30 sessions; Thursday, 13 sessions; Friday and Saturday will be devoted to field trips and excursions.

F. R. MOULTON,
Permanent Secretary

SCIENTIFIC NOTES AND NEWS

DR. WILLIAM WALLACE CAMPBELL, director emeritus of the Lick Observatory and president emeritus of the University of California, died by suicide on June 14.

THE birthday honors of King George VI of England include the elevation to the peerage of Sir Josiah Stamp, the economist, director of the Bank of England, in 1936 president of the British Association for the Advancement of Science. His title will be Lord Stamp of Shortlands. The Order of Merit was conferred on Sir Arthur Stanley Eddington, Plumian professor of astronomy at the University of Cambridge and director of the observatory. Lord Stamp arrived in New York on June 9. He gave the commencement address at the Johns Hopkins University on June 14.

THE Lord President of the Council of the Department of Scientific and Industrial Research, London, has appointed Dr. Ralph Howard Fowler, Plummer professor of applied mathematics in the University of Cambridge, to be director of the British National Physical Laboratory. Dr. Fowler will succeed Dr. W. L. Bragg, who has been elected Cavendish professor of experimental physics in the University of Cambridge.

AT the centennial commencement exercises of Duke University the degree of doctor of laws was conferred on Dr. Lewis Hill Weed, professor of anatomy and director of the School of Medicine of the Johns Hopkins University.

DR. FLORENCE RENA SABIN, member of the Rockefeller Institute for Medical Research, received the degree of doctor of science at the commencement exercises of Russell Sage College, Troy, N. Y.

THE degree of doctor of laws was conferred on Professor Armin Otto Leuschner, chairman of the department of astronomy and director of the Students' Observatory of the University of California at Berkeley, on the occasion of the seventy-fifth commencement day exercises on May 21. President Sproul made the following citation: "Stimulating teacher, resourceful scholar, able administrator; inspirer of many of America's leading astronomers; authority on minor planets and inventor of effective methods for computing cometary orbits; staunch champion of high standards in education; loyal and unselfish servant of the university for a full half century." On the occasion of Dr. Leuschner's retirement from active service, which takes place on June 30, he will become professor of astronomy and director of the Students' Observatory, emeritus. He has been connected with the university for fifty years, the first two of which were spent at the Lick Observatory as a graduate student and voluntary assistant.

AT the one hundred and sixth commencement of New York University the degree of doctor of public health was conferred on Dr. Thomas Parran, surgeon-general of the U. S. Public Health Service. In conferring this degree Chancellor Harry Woodburn Chase said: "Thomas Parran, conspicuous for your services to the public health, you have shown rare intelligence and leadership in your work in our own state and in the nation at large. It is your great achievement to have been responsible in large measure for that marked change in public opinion which has made possible, for the first time in our history, a direct frontal attack on the scourge of social diseases. It is to-day our privilege to pay honor to what you have accomplished for our country and in token thereof I confer upon you the degree of doctor of public health."

PORTRAITS of Professor Edwin Grant Conklin and Professor Charles Freeman Williams McClure will be presented by the department of biology to Princeton University on Baccalaureate Sunday, June 19.

A PORTRAIT of Professor Robert J. Terry, head of the department of anatomy of the Medical School of Washington University, St. Louis, was presented to the university on June 4 by the Medical School Alumni Association at a dinner given in his honor. The establishment was announced of a fund to be known as the Robert J. Terry Fund, which will be used to provide facilities for the promotion of anatomical research. The presentation was made by Dr. Louis H. Jorstad, president of the Alumni Association, and was received on behalf of the university by Chancellor George R. Throop. Professor Terry has been head of the department for thirty-eight years.

A DINNER was given on June 3 in honor of Dr. Horace C. Richards, professor of mathematical physics and director of the Randal Morgan Laboratory of Physics of the University of Pennsylvania, who will retire with the title emeritus on July 1 after teaching for fifty years. The dinner took place at the University Christian Association under the auspices of the Physics Club of Philadelphia. A portrait of Dr. Richards, painted by John Peirce, of Philadelphia, was presented to the university by the club.

THE officers, executive committee and members of the Division of Geology and Geography of the National Research Council, for the year beginning July 1, are as follows: *Chairman,* Chester R. Longwell; *Vice-chairman,* Preston E. James; *Executive Committee,* Chester R. Longwell, Preston E. James, Norman L.

Bowen, F. H. Lahee, John L. Rich, John K. Wright; *Representatives of Societies,* Stephen R. Capps and John L. Rich, Geological Society of America; J. F. Schairer, Mineralogical Society of America; Charles E. Resser, Paleontological Society; Preston E. James and C. Warren Thornthwaite, Association of American Geographers; John K. Wright, American Geographical Society; Edson S. Bastin, Society of Economic Geologists; Robert B. Sosman, American Ceramic Society; F. H. Lahee, American Association of Petroleum Geologists; *Members at Large,* Norman L. Bowen, Chester R. Longwell and L. F. Thomas.

DR. EDWARD L. MORELAND, who succeeded Dr. Dugald C. Jackson as head of the department of electrical engineering of the Massachusetts Institute of Technology in 1935, has been appointed dean of engineering. He succeeds Dr. Vannevar Bush, vice-president of the institute, who has resigned to become president of the Carnegie Institution of Washington.

DR. ELMER CULLER, of the University of Illinois, has been appointed professor of psychology and director of the psychological laboratories at the University of Rochester. He succeeds Dr. Leonard Carmichael, who last February resigned as dean of the Faculty of Arts and Sciences and professor of psychology in order to accept the presidency of Tufts College and the directorship of its research program in psychology.

DR. ALLAN C. G. MITCHELL, chairman of the department of physics at New York University (University Heights), has been appointed head of the department of physics at Indiana University.

DR. R. RUDOLF K. BERNHARD, engineer and consultant with the Baldwin-Southwark Corporation, Philadelphia, has been appointed professor and head of the department of mechanics and materials of construction at the Pennsylvania State College. He will succeed P. B. Breneman, who will retire with the title emeritus at the close of the academic year.

DR. ALBERT B. NEWMAN, head of the department of chemical engineering at Cooper Union, has been appointed professor and head of the department of chemical engineering of the College of the City of New York. In keeping with the general plan to develop the school of technology of the college, a separate department of chemical engineering was authorized two years ago by the Board of Higher Education. Until now the development of this department has been under the general supervision of the professor of chemistry, Dr. Herbert R. Moody.

DR. RUTH E. FAIRBANK, associate in psychiatry at the Johns Hopkins University, has been appointed professor of hygiene at Mount Holyoke College.

PROFESSOR EDMUND W. SINNOTT, of Barnard College, will in the course of the next two years be transferred from the department of botany of the college to the new laboratory of genetics to be established for research on growth and inheritance in plants and animals, at Columbia University, where he will work in collaboration with Professor Leslie C. Dunn, of the department of zoology. Beginning on July 1 Professor Sinnott will divide his time between the new laboratory and the department of botany at Barnard College.

DR. RICHARD WEISSENBERG, formerly professor extraordinarius of anatomy at the University of Berlin and last year visiting professor of cytology at the School of Medicine of Washington University, St. Louis, has been appointed a fellow at the Wistar Institute of Anatomy and Biology and will undertake research at the Effingham B. Morris Biological Farm at Bristol, Pa.

DR. ALEXIS CARREL, member of the Rockefeller Institute for Medical Research, will retire on July 1, when he will have reached the automatic retiring age limit of sixty-five years.

The Evening Star, Washington, D. C., states that two joint resolutions for appointment to the Board of Regents of the Smithsonian Institution, other than members of Congress, were introduced on June 7 by Chairman Keller, of the House Library Committee. One provides that R. Walton Moore, solicitor of the State Department, shall succeed himself for the statutory term of six years after June 29. The other would fill the vacancy caused by the death of Augustus P. Loring by the appointment for the six-year term of Dr. Arthur H. Compton, professor of physics at the University of Chicago.

DR. WILLIAM K. GREGORY, curator of the department of comparative anatomy of the American Museum of Natural History, and Dr. Milo Hellman, research associate in physical anthropology, sailed on June 4 for Pretoria, South Africa, near Aliwal North, Cape Colony.

DR. THOMAS PARRAN, JR., surgeon-general of the U. S. Public Health Service, gave the commencement address at Skidmore College, Saratoga Springs, N. Y., on June 5.

DR. FRANK CHARLES MANN, director of the Division of Experimental Surgery and Pathology of the Mayo Clinic, Rochester, Minn., was the commencement speaker at Indiana University on June 13.

PROFESSOR H. E. BIESTER, retiring president of the Iowa State College chapter of Sigma Xi, gave an address on June 11 on "Some Aspects of Virus Infections and Ovine Listerellosis."

DR. HAROLD GLENN MOULTON, president of the Brookings Institution, Washington, D. C., gave the commencement address at Goucher College, Baltimore, on June 7. He discussed the trend in economic thought during the last hundred years.

A "SOCIAL Science Luncheon" will be given in the Quebec Suite of the Chateau Laurier on Thursday, June 30, at 12 o'clock, for all sections and affiliated societies interested in the social sciences and meeting with the American Association for the Advancement of Science at Ottawa. The purpose is acquaintance and unofficial planning for the promotion of knowledge of these sciences in connection with the association. There will be brief after-dinner talks by officers of the several groups. The meeting will adjourn at 2 P. M. Members of these organizations and any who are interested may reserve plates for themselves and guests at $1.25 each by writing to Dr. Leroy Allen, executive secretary of the National Social Science Honor Society, Pi Gamma Mu, 1414 E. 4th Ave., Winfield, Kansas. The tickets so reserved may be obtained and paid for at the door of the dining-room, but must be reserved in advance.

A GATHERING of scientific men interested in the precision manufacture of metal products, or analysis of metals, that has come to be known as the "Jena Fall Courses," will be held this year during the last week of September at the Zeiss Works in Jena, Germany. The lectures, many by well-known scientific men, will cover a wide field of subjects, such as spectrographic analysis, the design, manufacture and use of precision measuring instruments, microscopy, metallography, precision methods of gauging and their international importance, etc. The lecture halls will be held open for about four days following the meetings to give opportunity for a study of the instruments discussed at the conference.

ACCORDING to an account in *Nature* a conference on rural health for Far Eastern countries has been held by the Governor-General at Bandoeng, Java. This conference was arranged by the League of Nations Health Organization under the presidency of Dr. T. Offringa, director of the Netherlands Indies Public Health Service, with Dr. J. Rajchman, medical director of the League Health Committee, as secretary, assisted by Dr. C. L. Park, director of the Eastern Bureau of the Health Organization. The conference met in five sections, in which the following subjects were discussed: (1) health and medical services: the advantages and disadvantages of training "semi-qualified" or assistant doctors to assist the qualified medical staff, and possible alternatives; (2) rural reconstruction and collaboration of the population, with the view of improving conditions of life in rural districts, a policy favored by the government of India and other countries; (3) sanitation and sanitary engineering, including housing, water supply, latrines, refuse disposal and fly control; (4) nutrition, a subject of importance in the East, for it has been estimated that seventy-five per cent. of the population of Asiatic countries exists on a diet below the standards fixed by European science; (5) measures necessary to combat specific diseases, such as malaria, plague, tuberculosis, hookworm infection, yaws and leprosy, and mental diseases; also drug addiction.

THE presidium of the Academy of Sciences of the U.S.S.R., according to the London *Times*, has decided to create a permanent scientific base on Mount Elbrus, in the Caucasus, to be known as the Institute of Research in High Altitudes. The institute will be built at Shelter No. 9, at a height of 13,944 feet, on the site at present occupied by a small high-mountain meteorological station.

DISCUSSION

ADMINISTRATIVE SPECIES

IN a recent paper on the salmon of New England, Kendall emphasizes the difference between taxonomic and natural species. Natural species are groups that have certain natural relationships between the individual members and also certain definite (but not necessarily definable) differences from the aggregate of members of other groups. Taxonomic species are convenient groups (we might call them pigeon-holes) in which to include or file away specimens having groupings of characteristics that fall within certain limits of variability. Taxonomic species may or may not conform closely to natural ones. In theory, the two should agree exactly. Whether they do or not is largely a matter of accident and is related directly to our knowledge of the whole group of organisms to which the various species under consideration may belong. Our increasing knowledge is reflected in the "splitting" to which the specific groups of the older systematists have been subjected. Since we lack the essential completeness of knowledge for entirely accurate definition of species, it must follow that some of our so-called species are actually parts of a single natural one. In other cases, it is just as certain that a taxonomic species will include all or parts of more than one natural species. In still other cases our empiric separations will be essentially correct. A further necessary consequence of our lack of knowledge is that, in many cases, we are not able to delimit correctly the boundaries of species and so are not able to decide whether a given specimen belongs, properly, to one or another. If we knew the complete story of

the specimen: ecological, racial, biological, genetical, etc., and could then evaluate each factor correctly, we might not only be able to determine exactly the species to which that individual should be assigned but might even say with assurance that it was of mixed origin and indicate by a fraction its inheritance from each group.

It has recently become apparent that we must add another grouping to these two kinds of species. Perhaps as good a name as any for the kind to which I refer would be "administrative species." An administrative species, then, would be an aggregation of organisms of more or less similar appearance under a single name for some specific purpose, usually, in this country, for the administration of some kind of regulatory measures. Perhaps an extreme example of administrative species would be the "wild duck" of some of our earlier game laws.

Two examples of administrative species have very recently come to my attention. In one case, which occurred in another state, I must, for obvious reasons, be rather vague in some statements. Some fish specimens were taken to a certain man for identification. They evidently belonged to a particular section of a large and popular group of game fishes. It was also evident that they pertained to one or the other of two groups, neither of which agrees very closely with a single taxonomic species but is rather a hybrid aggregation of derivatives from several taxonomic (and perhaps natural) species. The man to whom they were submitted felt that it was necessary for him to make a definite, decisive statement in the case, and did so. When he sought confirmation of his decision, he found that others, who had considerable experience with that group, did not agree with him. After some lengthy discussion he came to the conclusion that these particular fishes could not be adequately protected under one name but could under the other. Therefore, so far as he was concerned, those fishes were definitely the species that he considered could be given the protection that they obviously required. Whether he was right or wrong in all or part of his ideas does not alter the fact that this is an excellent example of an administrative species.

In the present fish and game code of Illinois, we have another example of an administrative species. The little grass pickerel, *Esox americanus,* called *Esox vermiculatus* by various authors, and the northern pike, *Esox lucius,* are grouped together under the administrative name "Pickerel." No individuals of this "species" less than sixteen inches long may be taken, regardless of the fact that the grass pickerel so rarely reaches that size that it is not likely than any fisherman will ever see one of legal length. This ruling also ignores that fact that the grass pickerel might be a very interesting game fish if its capture were permitted. This part of the code also fails to take into account the fact that the grass pickerel is one of the most efficient destroyers of young bass, sunfish and perch in the waters of this state. The young are hatched early in the spring and are large enough to eat young bass in early summer when the latter leave their nests and scatter into the weed beds for food and protection. The grass pickerel spend their entire lives in the weed beds and must surely account for a very large part of the losses of bass and sunfish less than a year old.

There is one respect in particular in which the Illinois code of fish and game laws is highly commendable. The fish species mentioned in that code are defined by being referred to the names and descriptions published in a standard technical work on the fishes of the state.

ALFRED C. WEED

FIELD MUSEUM, CHICAGO

NAMES OF THE FOUR CULTURE ROOTS IN THE SOUTHWEST

GLADWIN[1] recognized four basic cultures in the Southwest. He called these "roots" and named them the Caddoan Root, Basket-Maker Root, Hohokam Root and Yuman Root. Although most of the archeologists who are familiar with the Southwest agree that such a four-fold division is valid, yet many have taken exception to some of Gladwin's terms.

Gladwin used Basket-Maker Root for that basic culture which grew into the Pueblo culture. Some archeologists call this the Basket-Maker-Pueblo Root, others the Pueblo Root. Kidder,[2] feeling that the word Basket-Maker and Pueblo brought up pictures in the mind that were not always true, suggested the term Anasazi, a Navajo name for "old people."

The word Hohokam was proposed by Russell[3] for the ancient people who dwelt in the valleys of the Gila and the Salt. It is a Pima Indian name meaning "that which has perished." Huntington, 1914, applied the word to cover all the ancient people of the Southwest on the plateau as well as on the desert. Gladwin[4] proposed that the word Hohokam be restricted to the ancient people who dwelt in the Salt and Gila Valleys in Arizona. The name is very appropriate and has been widely accepted and is in good usage.

The words Caddoan and Yuman have been criticized because they are names of Indian languages and so infer that the ancient people of the region spoke those tongues. Gladwin called one of the principal branches

[1] Winifred and Harold S. Gladwin, Medallon Papers No. XV, p. 3, 1934.

[2] A. V. Kidder, "The Pueblo of Pecos." Vol. 2, p. 590, New Haven, 1936.

[3] Frank Russell, 26th An. Rpt. B.A.E., p. 24, 1908.

[4] *Loc. cit.*

of his Caddoan Root, in the Southwest, Mogollon. Usage has slowly shifted the meaning of the word Mogollon from a branch name to a root name. Mogollon is an excellent name for a root as the various phases in this root include the Mogollon Mountains in New Mexico and the Mogollon rim in Arizona as well as surrounding areas. Mogollon is derived from the name of Governor Flores of New Mexico, 1712–1715, whose full name was Don Juan Ignacio Flores de Mogollon, Captain General of New Mexico.[5]

The name Yuman also refers to an Indian language group and has met the same criticism as Caddoan. To avoid any suggestion of this kind, we suggest the name Pataya for this root. Pataya is the Walapai name for ancient people. Patayan is the adjective.

For the four roots of Southwestern Culture we then have the names Anasazi or Pueblo, Hohokam, Mogollon and Patayan. Usage alone will establish the terminology.

HAROLD S. COLTON
MUSEUM OF NORTHERN ARIZONA

ALLEGED BIRTH OF TRIPLETS IN THE RHESUS MONKEY

ON April 16, 1938, a shipment of rhesus monkeys, consigned to Henry Trefflich, animal dealer, arrived in New York Harbor from India. In one large box six fully mature females were caged, of which one was in possession of three babies; hence word went forth that for the first time in history birth of triplets in a monkey would be recorded. The event was, indeed, so "recorded" in the daily press. The mother was duly photographed, holding only two babies, however, for one had died during the night.

By good fortune I happened to be on the ground and was able to analyze the interesting situation with regard to the alleged multiple birth. On the basis of the following facts, I was forced to the conclusion that the case was not one of multiple birth but one of multiple kidnapping.

In the first place I palpated the uteri of the cagemates and found that two of them had also given birth quite recently, one so recently in fact that she had not yet delivered the afterbirth, for the placental discs were readily palpable. The second female had delivered a baby some days, perhaps even a week, before.[1]

It seemed most likely, therefore, that two additional females had rightful claims upon babies in possession of the allegedly prolific mother. But any doubt that existed was all but dispelled by inspection of this female's ovaries. After a couple of weeks all three babies were dead and the monkey was acquired by the Carnegie Colony. Laparatomy performed on May 20 disclosed a *single distinct corpus luteum* quite characteristic of the early puerperium.

We may, therefore, interpret the case as follows: Of 3 pregnant females caged together, *A* gave birth to a baby which was later adopted by *B*. The latter and female *C* delivered babies the same day (parturitions are said to have been witnessed by members of the ship's crew and mistakenly attributed to the same female) and *B* promptly got into possession of *C*'s baby also.

Kidnapping is not uncommon among monkeys. I have photographed such a case.[2] Doubling up babies in this way is a favorite trick of zoo authorities and other exhibitors for enhancing the public's interest in the collection.

Theoretically, it is of course possible for monkeys to produce triplets. Marmosets occasionally do so, as Dr. Geo. B. Wislocki has observed. Twins are the rule in marmosets and have been reported with some frequency in other primates which are normally uniparous. But the New York case of alleged triplets here reported must be dismissed as three single births under conditions favorable to double kidnapping by a mother well endowed with the "retrieving" instinct.[3]

CARL G. HARTMAN
DEPARTMENT OF EMBRYOLOGY,
CARNEGIE INSTITUTION OF WASHINGTON,
BALTIMORE

CYANIDE BEARING ORE MILL REFUSE AS A MENACE TO FISH LIFE

DESTRUCTION of the fish in a small tributary to the upper Columbia River, Washington State, was traced to refuse from an ore mill using the cyanide process for the recovery of gold. The small watercourse was strewn with dead eastern brook trout, *Salvelinus fontinalis*, and cottoids, *Cottus* sp. The area of destruction began immediately in front of the mill and extended throughout the lower portion of the stream. No live fish were observed in this region, although several live frogs were seen. A duck of unidentified species carried away one of the dead fish, showing the possibility of damage to waterfowl. The vegetation and bottom of the creek were covered with a thin film of finely divided ore from a flow of tailings into the creek.

Plant records show that 230 pounds of NaCN are used during a day's milling of approximately 85 tons of ore. Filter sludge deposited on the tailing pile carried 1.21 pounds of NaCN per ton, dry weight, and 5.4 pounds per ton, dry weight, were found in the filter by-pass solution. Analysis of material on the refuse pile for a year or more showed 0.04 to 0.08 pounds of

[5] Will C. Barnes, *Univ. of Ariz. Gen. Bul.* No. 2, p. 282, January 1, 1935.

[1] Hartman, "Contributions to Embryology," 1932.

[2] Frontispiece, Hartman and Straus' "Anatomy of the Rhesus Monkey," Baltimore, 1933.

[3] Wiesner and Sheard, "The Maternal Behavior in the Rat," London, 1933.

NaCN per ton, dry weight. This indicates that rain and melting snow leach the highly soluble cyanide from the pile and, of necessity, carry it into the creek.

Controlled experiments showed that locally raised eastern brook trout died in forty-seven minutes in a dilution of the mill effluent equivalent to 2.0 p.p.m. of NaCN. Lack of time prevented experiments with more dilute solutions. The menace of accumulating waste piles of this nature is worthy of more consideration for a large quantity may accumulate to be leached by melting snow and rain.

RICHARD T. SMITH
STATE DEPARTMENT OF FISHERIES,
SEATTLE, WASH.

SOCIETIES AND ACADEMIES

THE ALABAMA ACADEMY OF SCIENCE

IN spite of storms, floods and blocked highways, the fifteenth annual meeting of the Alabama Academy of Science held at State Teachers College, Troy, on April 8 and 9, under the presidency of Roger W. Allen, Alabama Polytechnic Institute, Auburn, proved one of the most successful in the history of the academy. Over sixty members and as many visitors registered with an accompanying meeting of over one hundred participating in the Junior Academy. In addition to the scientific program, which was given in four sections on Friday afternoon and Saturday morning, and the business sessions, entertainment features were varied. These included a luncheon, social and banquet, followed by sound movies at Shackelford Hall, a complimentary barbecue by the college and various field trips, including the geological and botanical one to Pocosin, conducted by Walter B. Jones and Roland M. Harper, of the Geological Survey. All business and scientific sessions were held at Bibb Graves Hall. C. M. Farmer, head of the biology department of the State Teachers College, Troy, was chairman of local arrangements with James Holt Starling, Troy High School, serving for the juniors.

The main feature of the banquet was the presidential address entitled "Anomalous Alabama." The guests were welcomed by C. B. Smith, president of the college, and the response given by R. S. Poor, of Birmingham-Southern College, who substituted for J. L. Brakefield, of Howard College.

The academy award from the American Association for the Advancement of Science, which has been held for the past three years by Septima Smith, of the department of zoology of the University of Alabama, was given to J. Gordon Carlson, of the same department. Montgomery was selected as the meeting place for 1939, with Huntingdon College as host college. The treasurer, B. F. Clark, reported thirty-six new members added during the year.

Dr. George D. Palmer, associate professor of chemistry, University of Alabama, was chosen as president-elect of the academy and was also selected as vice-president for next year. The president for 1938–1939 is P. H. Yancey, of Spring Hill College, Mobile (elect of last year). Other officers of the academy include: Septima Smith, *secretary* (reelected last year for three years); John Xan, Howard College, *treasurer;* J. H. Coulliette, Birmingham-Southern College, *councilor to the American Association for the Advancement of Science* and the chairmen of the sections, who serve as vice-presidents of the academy, namely: E. V. Smith, of Alabama Polytechnic Institute, Auburn, Section I, Biology and Medical Sciences; G. D. Palmer, of the school of chemistry of the University of Alabama, Section II, Chemistry, Physics and Mathematics; Miss Winnie McGlamery, of the Geological Survey of Alabama, Section III, Geology, Anthropology and Archeology; and J. F. Glazner, of State Teachers College, Jacksonville, Section IV, Industry, Economics and Geography. Dr. James L. Kassner, of the school of chemistry, University of Alabama, was retained as acting permanent counselor to the Junior Academy and N. R. Brundrett, of Phillips High School, as counselor.

Officers who served the academy for this year are: Roger W. Allen, *President;* B. F. Clark, Birmingham-Southern College, *Treasurer;* P. D. Bales, Howard College, *Councilor to the American Association for the Advancement of Science, and the vice-presidents;* Section chairmen: J. Gordon Carlson, of the department of zoology, University of Alabama, Section I; G. W. Hargreaves, of Alabama Polytechnic Institute, Auburn, Section II; Peter A. Brannon, of the Department of Archives and History, Montgomery, Section III; and John Xan, Howard College, Section IV. Secretaries who served the respective sections included: W. F. Abercrombie, Howard College; G. D. Palmer, University; James M. White, Sr., Montgomery, and V. A. Scalce, Birmingham.

SEPTIMA SMITH,
Secretary

THE SOUTH CAROLINA ACADEMY OF SCIENCE

THE fifteenth annual meeting of the South Carolina Academy of Science was held at the Charleston Museum and at The Citadel, Charleston, South Carolina, in joint session with the South Carolina Section of the American Chemical Society and the South Carolina Section of the Southern Society for Philosophy

and Psychology, on April 9, 1938. More than two hundred members attended.

The morning session was devoted to papers of a more general interest, papers in the Jefferson Medal competition, and the address, "Lightning and Lightning Protection," of the retiring president, Professor A. C. Carson, of the University of South Carolina. The afternoon session was divided into sections of Biology, Chemistry, Mathematics, Philosophy-Psychology, Geology and Physics.

At the business session the following officers for 1938–39 were elected:

President: Dr. G. G. Naudain, Winthrop College, Rock Hill, S. C.

Vice-president: E. B. Chamberlain, Charleston Museum, Charleston, S. C.

Secretary-Treasurer: Dr. G. N. Collings, Clemson College, Clemson, S. C.

Curator: Dr. J. E. Copenhaver, University of South Carolina, Columbia, S. C.

Editor: To be appointed.

Executive Committee: Dr. J. E. Mills, Sonoco Products Company; Professor A. C. Carson, University of South Carolina; Dr. C. D. Riddle, Furman University; Dr. R. M. Byrd, The Citadel; Professor J. J. Petty, University of South Carolina.

The Jefferson Medal for the outstanding paper was awarded to Dr. H. D. Bruner, of the Medical College of the State of South Carolina, for a paper entitled "The Blood Picture of Rats from Birth to Twenty-Four Days of Age." The 1938 Research Fund was granted to Dr. Jessie Reed Cockrill, of the Medical College of the State of South Carolina.

The next meeting will be held in the spring of 1939 in Columbia, South Carolina.

F. W. KINARD,
Retiring Secretary

MINNESOTA ACADEMY OF SCIENCE

THE sixth annual meeting of the reorganized Minnesota Academy of Science was held at St. John's University, Collegeville, Minnesota, on Saturday, April 23. More than 200 people attended the programs of the various sections. Five papers were read to the entire group in the morning. In the afternoon 25 papers were presented in the Biological and Physical Sciences and Science Education sections. For the first time, a Junior Academy program was given. Representatives from four high school science clubs gave papers. Several club exhibits were arranged by the Junior group. In the evening, at an open meeting Dr. William Carpenter MacCarty, of the Mayo Foundation, gave an address entitled, "Individualism and Collectivism in Nature." At the business session nearly 200 members were taken into the academy, making a total membership of well over 600.

American Association for the Advancement of Science Research grants of $55 were made to Dr. Alfred M. Elliott, of Bemidji Teachers College, and to Dr. John W. Moore, of the University of Minnesota.

Officers for 1938–39 are: *President,* L. M. Gould, Carleton College; *Vice-president,* R. B. Harvey, University of Minnesota; *Secretary-Treasurer,* H. K. Wilson, University of Minnesota. The councilors are E. M. Freeman, University of Minnesota; E. T. Tufte, St. Olaf College; H. E. Essex, Mayo Foundation; and L. H. Powell, St. Paul Institute. The officers of the Junior Academy are: *President,* M. H. Kuhlman, Stillwater, and *Secretary-Treasurer,* Lewis L. Barrett, of Edison High School, Minneapolis.

The 1939 meeting will be held on Saturday, April 22, at Macalester College, St. Paul.

H. K. WILSON,
Secretary

SPECIAL ARTICLES

THE PERFUSION OF WHOLE ORGANS IN THE LINDBERGH APPARATUS WITH FLUIDS CONTAINING HEMOCYANIN AS RESPIRATORY PIGMENT[1]

ORGANS perfused in the Lindbergh apparatus[2] are ordinarily supplied only with dissolved oxygen. The use of red blood cells or hemolyzed blood leads to the formation of methemoglobin after six to eight hours, making perfusion for several days impossible. Attempts to prevent the formation of methemoglobin by adding glutathione or ascorbic acid were unsuccessful.

In order to provide more oxygen for the organs it was considered preferable to replace hemoglobin by another respiratory pigment, hemocyanin, rather than to increase the dissolved oxygen by increasing the oxygen tension. Hemocyanin was collected from *Limulus polyphemus* (about 100 cc of blood per crab). The blood was centrifuged to remove mucus and then dialyzed in Cellophane against running tap water until the conductivity showed that most of the electrolytes had dialyzed out. After removal of the protein precipitated by the dialysis, crude hemocyanin was precipitated by adding N/25 HCl, until the pH was about 6.4, and the solution was again centrifuged. The supernatant fluid was removed and the precipitate dissolved in 50 cc of cat plasma[3] which had been adjusted to a pH of 8.4. This mixture was then dialyzed against distilled water. The resulting solution, containing 4.5 per cent. hemocyanin, was made

[1] From the Department of Surgery of the College of Physicians and Surgeons, Columbia University, and the Department of Surgery of the Presbyterian Hospital, New York City.

[2] A. Carrel and C. A. Lindbergh, SCIENCE, 81: 621, 1935.

[3] Cat organs were used for the perfusion.

up to 250 cc by adding a Ringer-glucose solution, filtered through a Berkefeld N filter and placed in the perfusion apparatus.

In another series of experiments, the crude hemocyanin was dissolved in 60 cc of Ringer's solution which had been brought to a pH of 8.4. This fluid was centrifuged at a speed of 40,000 r.p.m. in a centrifuge constructed by Chiles. After centrifugation for one hour, the hemocyanin at the bottom of each tube was dissolved in plasma at a pH of 8.4.

The purpose of the experiments was to determine: First, whether or not the oxygen capacity of the perfusion fluid can be considerably increased by the addition of the respiratory pigment. Second, whether or not the isolated mammalian organ is able to reduce the hemocyanin and use its liberated oxygen for respiration. Third, whether or not the organs perfused with a fluid containing hemocyanin survive in better condition than control organs cultivated in serum and Ringer's solution alone.

By the addition of hemocyanin to the perfusion fluid, as described above, the oxygen capacity was brought up to 2.5 volumes per cent. Still higher values are possible, as the solubility of hemocyanin is high in the presence of sufficient electrolytes. The experiments have shown that oxyhemocyanin is reduced in mammalian tissues. This is evident by comparing the color of the arterial with that of the venous blood. Oxygenated hemocyanin, flowing into the organs, is blue. Reduced hemocyanin, pouring out of the veins, is colorless. The oxygen removed from each cubic centimeter of the perfusion fluid, calculated merely as the difference between arterial and venous O_2 contents, amounts to 0.10 cc for an adult cat's kidney and 0.001 cc for an adult cat's thyroid. These figures correspond with those obtained on the kidney by Van Slyke and Hiller in their heart-liver-kidney preparation.[4] The experiments herein described were undertaken at a temperature of 27° C., since the affinity of hemocyanin for oxygen decreases with increasing temperature.[5] The cultivation of organs, such as thyroid gland, skeletal muscle and intestine, do not, however, require hemocyanin in the perfusion fluid. The oxygen consumption of these organs is low, and their call for oxygen can be satisfied with the oxygen dissolved in a fluid containing 40 per cent. serum and 60 per cent. Ringer's solution (0.25 volumes per cent.). Other organs, however, such as kidney, nerve tissue and pancreas, with high oxygen requirements can not be successfully cultivated without the presence of an oxygen carrier in the perfusion fluid.

Organs have been perfused with hemocyanin solution for more than four days. A comparison of the histological pictures of these organs with those of organs from the same animal kept as controls in serum and Ringer's solution alone demonstrates that the hemocyanin is superior for perfusion over long periods. Experiments with hemocyanin in tissue culture showed a slight toxicity beginning at the concentration of 3.5 per cent. (unpublished observations). The toxicity of hemocyanin in tissue cultures does not, however, prove that it is toxic when perfused through whole organs, since the size of the hemocyanin molecule prevents it from passing through the capillary wall.

No trace of hemocyanin could be found in the urine of isolated kidneys kept alive for four days in the Lindbergh apparatus. Bayliss, Kerridge and Russell[6] have also demonstrated that hemocyanin is unable to pass through the glomerular capillary wall.

RICHARD BING

[4] D. D. Van Slyke, C. P. Rhoads, Alma Hiller and Alf S. Alving, *Am. Jour. Physiol.*, 109: 324, 1934.

[5] A. C. Redfield, *Biol. Rev.*, 9: 175, 1934.

[6] L. E. Bayliss, P. N. P. Kerridge and C. S. Russell, *Jour. Physiol.*, 77: 386, 1933.

ESTIMATION OF FIBER, FAT CELLS AND CONNECTIVE TISSUE IN MUSCLE

THIS paper presents a very brief account of a simple analytical technique for the separate estimation of the three main morphological elements of muscle. A representative portion of the muscle to be studied is cut into longitudinal strips about 50 mm long, 20 mm wide and 2 mm thick, and a 6–8-gm sample of the strips is employed for a test. To each sample, in a 125-ml Erlenmeyer flask, is added 30 ml of 5-N aqueous HNO_3 and maceration is allowed to proceed, at about 25°, for about 36 hours—or until fibers and fat cells have become disconnected and free; gentle agitation during the last two hours is desirable. The acid action is then stopped by dilution, and the liquid level is brought into the flask neck, by the addition of 90 ml of 0.01-N HNO_3. The upper portion of the liquid, with the floating fat cells, is next decanted off, and those cells are collected on Whatman filter paper No. 1, by means of Hirsch funnel and aspirator pump, the resulting filtrate being returned to the flask. After being dried to constant weight at 40°, the weight of the fat cells is recorded as a percentage (a) of the original weight of the muscle sample. The tangled mass of fibers is next separated from the liquid by filtering, as above, after which it is dried at 92°–95° and its weight is recorded as a percentage (b) of the original weight of the sample.

To the filtrate from the fibers is gradually added just enough aqueous solution of phosphotungstic acid (Merck "Reagent," 5 gm in each 100 ml) to complete the resulting precipitation. The precipitate, which represents a combination of phosphotungstic acid with material extracted from the muscle during maceration,

is removed by filtration, as above, and dried at 92°–95°, after which it is weighed and then incinerated (at about 550°) in a porcelain crucible. From the dry weight is subtracted the weight of the residual ash and the difference, expressed as a percentage (c) of the original weight of the sample, is taken as an approximate measure of the connective tissue originally present. The sum of the three weight percentages ($a+b+c$) is taken to represent the dry weight of the sample, and the difference between that sum and 100 is taken to represent the original water-content percentage (w).

Representative percentages obtained by means of this technique for samples of longissimus dorsi muscle from two hothouse-grown lambs are shown in the accompanying table, along with some additional percentage values derived from Barbella, Hankins and Alexander's analyses[1] of similar samples from the same individual muscles. The additional values are: P, total protein percentage from Kjeldahl decomposition (corresponding approximately to $b+c$); F, total fat percentage from ether extraction (corresponding approximately to a); W, total water percentage from acetone extraction (corresponding approximately to w); D, dry-weight percentage derived by subtracting W from 100 (corresponding approximately to $a+b+c$). Values secured by means of the new technique are shown in bold-face type.

	Lamb no. 423	Lamb no. 517
Fat cells (a)	**4.3**	**6.2**
Total fat (F)	3.1	4.8
Fiber (b)	**17.1**	**19.1**
Connective tissue (c)	**3.5**	**2.7**
Fiber and connective tissue ($b+c$)	**20.6**	**21.8**
Total protein (P)	21.8	21.2
Fat cells, fiber and connective tissue ($a+b+c$)	**24.9**	**28.0**
Total fat and protein ($F+P$)	24.9	26.0
Dry weight (D)	26.5	27.2
Water, by subtraction (w)	**75.1**	**72.1**
Water, by extraction (W)	73.6	72.8

These lambs were of different breeds, but both had received the same liberal ration. When killed, No. 423 was 117 da. old and No. 517 was 122 da. old, but their dressed weights were alike (29.5 lbs.). The fat-cell percentage (a) was 31 per cent. less for the first sample than for the other, while the fat percentage (F) was 35 per cent. less for the first; the two methods of analysis thus show essential agreement in this respect. But in each case a is greater than F, as might be expected, since a represents intact fat cells, while F represents only extracted fat. For each sample, $b+c$ is in essential agreement with P, $a+b+c$ is in essential agreement with $F+P$ and with D, and w and W are in essential agreement. Finally, it is to be noted that the new technique furnished values for fiber alone (b) and for connective tissue alone (c), for which no estimates can be derived from F, P, D and W.

The new procedures described above were developed partly in the U. S. Bureau of Animal Industry and partly in the laboratories of zoology and plant physiology of the Johns Hopkins University. For practical advice and criticism the writer is indebted to Dr. E. A. Andrews, Dr. R. P. Cowles, Dr. Hugh C. McPhee, Dr. Paul E. Howe and Mr. O. G. Hankins. Financial aid was received from the U. S. Works Progress Administration.[2] Dr. Burton E. Livingston has helped a great deal in the preparation of this paper.

HERBERT BAKER

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[1] *Proc. Am. Soc. Animal Prod.*, 1936, pp. 289–294.

A PHOTODYNAMICAL BIOELECTRICAL POTENTIAL

ALTHOUGH a great deal of valuable empirical work is now being done on the clinical and morphological aspect of electrical phenomena in animals, there is need of more information concerning the intrinsic mechanism involved comparable to what is known about the potentials in plant cells.

In the course of an extended study of the effect of temperature, oxygen, ions and heavy water on the potential of frog skin an interesting photodynamical effect has come to light. If a frog skin stained in 0.1 per cent. eosin is exposed to strong light from a carbon arc a striking and sudden increase in potential results. The skins were from the belly region tied in holders of 2 to 5 cc of stained Ringer's solution leading through

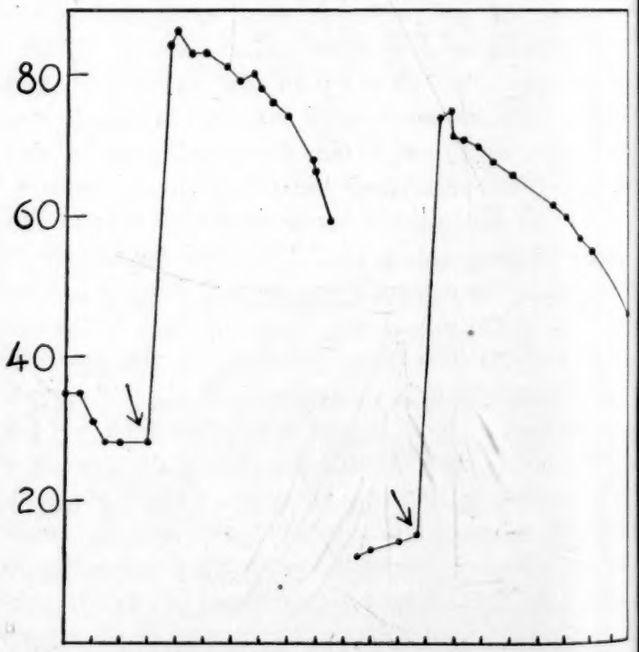

FIG. 1. Increase in potential of two frog skins transferred to Ringer's solution containing eosin and radiated (at arrows). Ordinates: e.m.f. in millivolts (outside surface is negative). Abscissae: time in ten-minute intervals.

[2] W. P. A., Maryland Project No. 47, 1936.

Ag-AgCl electrodes to a Type K potentiometer. The light was passed through ice water to avoid a heating effect. The rise in potential in nine skins was 28 to 86, 22 to 52, 15 to 75, 0 to 52, 20 to 50, 24 to 53, 14 to 32, 1 to 45 and 17 to 41 millivolts (see Fig. 1).

The photodynamic effect probably involves the oxidation of membrane proteins, as in muscle,[1] which might provide the slow colloidal anion capable of setting up a diffusion potential with a fast cation like K. Thus the radiated eosin has an effect opposite to that of heavy water.[2]

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THE SPECIFICITY OF PEPSIN ACTION

THE various enzymes which attack genuine proteins and which therefore are designated proteinases exhibit striking differences in the specificity of their chemical action. The clearest demonstration of these differences in enzymatic specificity has been obtained by means of synthetic substrates. Such substrates have recently been described[1] for all the known types of proteinases, with the exception of pepsin.

In this communication we wish to report the finding of a synthetic substrate for swine pepsin. Carbobenzoxy-*l*-glutamyl-*l*-tyrosine is extensively hydrolyzed in the presence of pepsin with the formation of carbobenzoxy glutamic acid and tyrosine; under our conditions the hydrolysis attained 70 per cent. in 3 days. This enzymatic hydrolysis occurs at pH 4. At the generally accepted pH optimum of pepsin—pH 2—, a hydrolysis of only 10 per cent. of the synthetic substrate was observed. Once recrystallized pepsin is more effective than a good commercial preparation.

The availability of synthetic substrates for pepsin makes possible a study of the specificities, homogeneity and kinetics of pepsin preparations from various animal species.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

A SYSTEM FOR NUMBERING LABORATORY ANIMALS

THERE are several systems in use for numbering experimental animals, and the following one, which makes use of permanent marks, has certain advantages over many of them.

The marks consist of notches, holes and slits in the ears, clipped toes and clipped tails (some species). Notches (made by scissors) in the right ear are taken as units and notches in the left ear as tens. Two positions on the ear are selected for the notches, the anterior margin or front portion, and the posterior margin or back portion. The notches give a continued sequence from 1 to 99 (see Table 1).

TABLE 1

Number of notches and position on margin	Right ear	Left ear
	No. of animal	No. of animal
1 front (anterior margin)	1	10
2 front " "	2	20
1 back (posterior margin)	3	30
2 back " "	4	40
1 front—1 back	5	50
2 " —1 "	6	60
1 " —2 "	7	70
2 " —2 "	8	80
3 "	9	90

Animal number 11 would have 1 notch placed in the anterior margin of the left ear and 1 notch placed in the anterior margin of the right ear.

The series is extended beyond 99 by punching holes in the ears. One hole in an ear designates animal No. 100 and nine holes designates No. 900.

The toes can be clipped off according to some plan and the readings combined with those from the marks in the ears. The toes of the animal are numbered clockwise when the animal is held by the back with its head up and its feet toward the worker. This is done by considering the leftmost toe on the right forefoot, analogous to the little finger on our right hands, as No. 1 and then counting the toes on the forefeet from left to right (clockwise). The toes on the hind feet are numbered from right to left (clockwise). Each toe would represent a thousand and therefore, if the No. 1 toe were clipped it would be animal No. 1,000. If the animal has 18 toes and the left one on the right hind foot were clipped, the animal would be No. 18,000. It is easy to select a combination of toes which will total 49,000 without incapacitating the animal. Then the total number obtained by combining the notches and holes in the ears and the clipped toes is 49,999.

A straight slit, placed in the tip of the right ear so that it does not pass through one of the holes, indicates No. 50,000 and a straight slit in the tip of the left ear signifies an additional 50,000.

[1] A. J. Kosman and R. S. Lillie, *Jour. Cell. and Comp. Physiol.*, 6: 505, 1935. For additional references *cf.* A. J. Kosman, *Jour. Cell. and Comp. Physiol.*, 11: 279, 1938.

[2] T. C. Barnes, SCIENCE, 83: 506, 1936.

[1] M. Bergmann, J. S. Fruton and H. Pollok, SCIENCE, 85: 410, 1937.

FIG. 1.

Fig. 1 illustrates how the marks would be in animal No. 201,111.

The clipping of tails for numbering animals is only applicable to certain species and, in some of these, it should be used with the greatest care. A clipped tail indicates animal No. 150,000. Then by combining the clipped tails with the previous parts of the system, a total of 299,999 animals may be numbered.

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PERMANENT MOUNTS OF HELMINTH EGGS IN AQUEOUS PRESERVING FLUIDS

IT is often desirable to prepare permanent mounts of helminth eggs by a simple technique which will eliminate the shrinkage and distortion that frequently occur in the longer process of dehydration and subsequent mounting in damar. In the following technique the eggs are mounted permanently on the slide in 4 per cent. formaldehyde: (1) Place the slide on a turn table and ring a cell with "Murrayite"; (2) fill the cell immediately with the preserving fluid (4 per cent. formaldehyde) containing the eggs. An excess of the preserving fluid should be placed in the cell to prevent trapping air bubbles; (3) place a circular coverglass in position immediately. With gentle pressure of the index fingers rotate the coverglass through an arc of approximately 30 degrees, thus pressing the edge into the soft cement. Usually the coverglass will adhere, even though the rim may have become wet with the overflowing preserving fluid; (4) allow the slide to dry over night and then re-ring it to insure a more permanent seal; (5) twenty-four hours later the slide can be rinsed in running water, dried with a cloth and labelled.

Similar permanent mounts of adults and larvae of *Trichinella spiralis* have been made by preserving them in an aqueous solution of 4 per cent. formaldehyde and 30 per cent. glycerine.

"Murrayite" adheres readily to the coverglass, even though the coverglass has been moistened previously with the preserving fluid. This is a distinct advantage, since in the use of other ringing cements it is necessary that the edges of the coverglass be absolutely dry. "Murrayite" is a spirit-proof cement used in sealing museum jars and microscopic fluid mounts. It was invented by Dr. C. Hay Murray, of Liverpool, and is sold by one or more American biological supply houses.

J. HENRY WALKER

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